

## Short Communication

# Hair Relaxers Not Associated with Breast Cancer Risk: Evidence from the Black Women's Health Study

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## Abstract

Hair relaxers (straighteners) have been used by millions of African American women, often for many years. Relaxer ingredients can enter the body through scalp lesions and burns. Because manufacturers are not required to list all ingredients, these products may contain unknown harmful substances. We assessed hair relaxer use in relation to breast cancer incidence in the Black Women's Health Study, a nationwide follow-up study of African American women. Information on hair relaxer use was collected in 1997; 48,167 women were followed subsequently through 2003 for incident breast cancer. Incidence rate ratios of breast cancer were estimated

with Cox regression. During 266,298 person-years of follow-up, 574 incident cases of breast cancer were ascertained. There were no increases in breast cancer risk associated with any categories of duration of hair relaxer use, frequency of use, age at first use, number of burns experienced during use, or type of relaxer used. The incidence rate ratio for use at least seven times a year for 20 or more years relative to use for less than a year was 0.98 (95% confidence interval, 0.78-1.39). These results suggest that hair relaxer use does not increase the incidence of breast cancer in African American women. (Cancer Epidemiol Biomarkers Prev 2007;16(5):1035-7)

## Introduction

African American women, especially younger women, commonly use hair relaxers to straighten their hair, often over periods of many years. "Lye" relaxers contain sodium hydroxide; no-lye relaxers contain calcium hydroxide and guanidine carbonate; and "thio" relaxers contain thioglycolic acid salts (1). There is no evidence that any of these substances is carcinogenic. However, hair relaxer ingredients are only partly monitored by the Food and Drug Administration: manufacturers need not list flavorings, fragrances, and ingredients that are trade secrets (2). California recently enacted the first state cosmetic regulatory law, the California Safe Cosmetics Act, which will require reporting of potentially harmful ingredients to the state, which will then inform consumers (3). Thus, the carcinogenic potential of hair relaxers is currently unknown. Hair relaxers can cause burns and lesions in the scalp, facilitating entry of hair relaxer constituents into the body (1, 4-7). The higher incidence of breast cancer in U.S. Black women than in U.S. White women before age 45 years is only partly explained by known risk factors (8, 9). In light of all these considerations, we assessed the relation of hair relaxer use to the incidence of breast cancer in African American women.

## Materials and Methods

The Black Women's Health Study began in 1995 when Black women, ages 21 to 69 years, from across the United States completed postal health questionnaires (9, 10). Fifty-nine

thousand women, whose names and addresses were deemed to be valid, have been followed every 2 years through postal questionnaires;  $\geq 80\%$  of the cohort has completed each follow-up questionnaire through 2003. Institutional review boards of Boston University and Howard University approved the study protocol. The participants provided consent by filling out questionnaires and giving written consent for medical records.

The baseline 1995 questionnaire obtained information on many factors including risk factors for breast cancer and medical history. Biennial follow-up questionnaires updated information on risk factors and ascertained incident breast cancer. The 1997 follow-up questionnaire included questions about use of "chemical hair straighteners": age at first use (<10, 10-19, 20-29,  $\geq 30$  years), frequency of use per year (about 1 time, 2 times, 3-4 times, 5-6 times,  $\geq 7$  times), total number of years of use (<1, 1-4, 5-9, 10-14, 15-19,  $\geq 20$ ), number of burns (a break in the skin, not just tingling) during the application of chemical straighteners (never, 1-2 times, 3-4 times, 5-9 times,  $\geq 10$  times), and type of formulation used most often (lye, no-lye, don't know).

During each follow-up cycle, we mail multiple waves of questionnaires to women who have not yet responded. During the 1997 cycle, 1,060 women returned duplicate questionnaires. Weighted  $\kappa$  values (11) for agreement between responses on the hair relaxer use questions were 0.79 for age at first use, 0.79 for frequency of use, 0.80 for duration of use, 0.71 for number of burns, and 0.54 for type of relaxer (all  $P < 0.05$ ) indicating good to excellent reproducibility.

The validation of self-reported cases of incident breast cancer in the Black Women's Health Study is an ongoing process. To date, 927 of 1,069 women who reported incident breast cancer since baseline in 1995 through 2005 have been approached, and medical record data have been obtained for 589 (64%) women. Among the latter, 586 (99.5%) women were confirmed to have had breast cancer, of which 88% was invasive cancer. An additional 135 women who were not willing to release their medical records because of concerns about confidentiality confirmed that their diagnosis was indeed breast cancer. Because of the high degree of accuracy

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**Table 1. Incidence of breast cancer in relation to hair relaxer use in the Black Women's Health Study**

	Duration of hair relaxer use (y)					
	Nonuse*	1-4	5-9	10-14	15-19	≥20
Cases	53	52	50	63	109	247
Person-years	20,009	18,541	26,917	52,649	58,444	89,737
IRR	Reference	1.17	1.02	0.85	1.19	1.03
95% CI	—	0.79-1.71	0.69-1.50	0.59-1.23	0.85-1.67	0.76-1.39
	Frequency of hair relaxer use (times per year)					
	Nonuse*	1	2	3-4	5-6	≥7
Cases	53	25	43	164	149	139
Person-years	20,009	7,208	17,930	69,898	71,702	77,263
IRR	Reference	1.44	0.98	1.03	1.06	1.04
95% CI	—	0.89-2.32	0.65-1.46	0.75-1.40	0.77-1.46	0.75-1.44
	Age at first hair relaxer use (y)					
	Nonuse*	<10	10-19	20-29	≥30	
Cases	53	13	223	201	80	
Person-years	20,009	13,366	140,304	72,344	19,394	
IRR	Reference	0.96	1.07	1.01	1.04	
95% CI	—	0.52-1.79	0.78-1.47	0.74-1.38	0.73-1.48	
	No. hair relaxer burns					
	Nonuse*	0	1-2	3-4	5-9	≥10
Cases	53	100	148	107	70	94
Person-years	20,009	41,508	69,043	52,616	33,458	48,654
IRR	Reference	0.95	1.02	1.05	1.20	1.14
95% CI	—	0.68-1.32	0.74-1.40	0.75-1.46	0.84-1.73	0.81-1.61
	Type of hair relaxer used					
	Nonuse*	Lye	No-lye	Unknown		
Cases	53	80	356	72		
Person-years	20,009	39,386	173,945	26,757		
IRR	Reference	1.16	1.07	1.05		
95% CI	—	0.82-1.65	0.80-1.43	0.74-1.49		

\*Never used or <1 y of use.

of reporting of breast cancer by Black Women's Health Study participants, we have included all self-reported cases of breast cancer in the analysis, with the exception of the cases disconfirmed by medical record data.

We began follow-up for the present analysis in 1997, the year in which the information on hair relaxers was collected, and we assessed that use in relation to the subsequent occurrence of breast cancer reported on the 1999, 2001, and 2003 questionnaires. Among 53,177 women who completed the 1997 questionnaire, 5,010 were excluded because they had prevalent breast cancer (826) or another cancer (662), did not complete the information on hair relaxer use (793), or did not complete a follow-up questionnaire after 1997 (2,729), which left 48,167 women for the present analysis.

Age-stratified Cox regression was used to estimate incidence rate ratios (IRR) for hair relaxer use in relation to the incidence of breast cancer (12). The Anderson-Gill data structure was used to update time-varying covariates (13). Women who never used hair relaxers (2,255) or used them for less than a year (1,394), referred to hereafter as "nonusers," composed the reference category for the estimation of IRRs. Women contributed person-years from 1997 until the occurrence of breast cancer, loss to follow-up, death, or the end of follow-up in 2003, whichever came first. Control for age at menarche, age at first birth, parity, family history of breast cancer, benign breast disease, alcohol use, physical activity, educational attainment, and geographic region of residence did not alter the IRRs by

>2%. We therefore controlled only for age (1-year intervals) and questionnaire cycle in the Cox models.

## Results

Women <45 years of age were more likely to use hair relaxers than older women (94% versus 89%). Use before age 20 years (73% versus 30%) and use with a frequency of at least 7 times a year (33% versus 22%) were also greater among the younger women. There was little variation in use across categories of the breast cancer risk factors considered as potential confounders in the present analyses.

During 266,298 person-years of follow-up, 574 cases of incident breast cancer were ascertained. The IRR for hair relaxer use relative to nonuse was 1.04 [95% confidence interval (95% CI), 0.78-1.39]. IRRs were close to 1.0 for all categories of duration of use, frequency of use, age at first use, years of use, and type of relaxer used (Table 1). Among the women with more intensive use, those who used hair relaxers 7 or more times a year, the IRR for ≥20 years of use compared with no use was 0.98 (95% CI, 0.78-1.39). Results were unchanged when *in situ* cases were excluded.

Within strata of age (<45 and ≥45 years), none of the IRRs differed materially from 1.0 (Table 2).

For use at least 7 times a year for ≥20 years relative to nonuse (Table 3), the IRR was 0.84 (95% CI, 0.42-1.71) among women <45 years of age and 1.03 (95% CI, 0.68-1.56) among women ≥45 years of age.

## Discussion

In the present study of African American women, increases in breast cancer risk were not associated with any categories of duration of hair relaxer use, frequency of use, age at first use, number of burns experienced during use, or type of relaxer used. Of particular interest, null associations were observed among younger women who used relaxers at earlier ages and more frequently than older women. Thus, the findings provide empirical evidence that hair relaxers are not carcinogenic to the breast and do not contribute to the higher incidence of breast cancer in African American women than in White women before age 45 years.

Hair dye use has been associated with an increased risk of various cancers in some studies, but these results have generally not been confirmed (14). The present study is the first to assess hair relaxers in relation to a cancer.

Because our study was prospective, biased reporting of hair relaxer use is not a concern, although random misclassification of use would have tended to dilute associations. Follow-up rates were sufficiently high to allay concerns about selective losses. We found that self-reports of breast cancer were accurate and that potential confounding factors did not alter the risk estimates. The study was large and had excellent statistical power to detect small increases in risk. Because the study had no information on individual brands, however, a harmful effect of particular products cannot be ruled out.

## Acknowledgments

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**Table 2. Risk of breast cancer in relation to hair relaxer use according to age (<45, ≥45) in the Black Women's Health Study**

	Age <45 y					
	Duration of hair relaxer use (y)					
	Nonuse*	1-4	5-9	10-14	15-19	≥20
Cases	12	16	11	25	55	62
Person-years	8,875	9,250	17,409	40,450	43,773	36,099
IRR	Reference	1.28	0.60	0.66	1.10	0.98
95% CI	—	0.60-2.70	0.26-1.36	0.33-1.32	0.59-2.07	0.53-1.82
	Frequency of hair relaxer use (times per year)					
	Nonuse*	1	2	3-4	5-6	≥7
	Cases	12	6	10	41	59
Person-years	8,875	3,631	8,708	36,782	44,237	52,417
IRR	Reference	1.23	0.83	0.84	1.08	0.90
95% CI	—	0.46-3.27	0.36-1.93	0.44-1.60	0.58-2.00	0.48-1.68
	Age at first hair relaxer use (y)					
	Nonuse*	<10	10-19	20-29	≥30	
	Cases	12	6	113	48	2
Person-years	8,875	11,952	104,756	27,819	1,960	
IRR	Reference	0.58	0.97	0.98	0.45	
95% CI	—	0.22-1.55	0.53-1.75	0.52-1.84	0.10-2.00	
	No. hair relaxer burns					
	Nonuse*	0	1-2	3-4	5-9	≥10
	Cases	12	27	41	34	28
Person-years	8,875	19,250	39,755	31,953	22,351	33,181
IRR	Reference	1.06	0.80	0.87	1.06	0.97
95% CI	—	0.54-2.09	0.42-1.53	0.45-1.69	0.54-2.09	0.51-1.86
	Type of hair relaxer used					
	Nonuse*	Lye	No-lye	Unknown		
	Cases	12	30	119	17	
Person-years	8,875	26,199	106,237	11,456		
IRR	Reference	1.03	1.01	1.21		
95% CI	—	0.53-2.02	0.56-1.82	0.58-2.53		

**Table 2. Risk of breast cancer in relation to hair relaxer use according to age (<45, ≥45) in the Black Women's Health Study (Cont'd)**

	Age ≥45 y					
	Duration of hair relaxer use (y)					
	Nonuse*	1-4	5-9	10-14	15-19	≥20
Cases	41	36	39	38	54	185
Person-years	11,134	9,291	9,508	12,198	14,672	53,638
IRR	Reference	1.11	1.23	0.97	1.19	1.04
95% CI	—	0.71-1.74	0.79-1.91	0.62-1.51	0.79-1.80	0.74-1.47
	Frequency of hair relaxer use (times per year)					
	Nonuse*	1	2	3-4	5-6	≥7
	Cases	41	19	33	123	90
Person-years	11,134	3,577	9,222	33,116	27,465	24,846
IRR	Reference	1.51	1.02	1.09	1.02	1.10
95% CI	—	0.87-2.60	0.64-1.62	0.77-1.56	0.70-1.49	0.76-1.61
	Age at first hair relaxer use (y)					
	Nonuse*	<10	10-19	20-29	≥30	
	Cases	41	7	110	153	78
Person-years	11,134	1,413	35,548	44,525	17,434	
IRR	Reference	1.66	1.09	1.02	1.10	
95% CI	—	0.74-3.72	0.75-1.59	0.72-1.44	0.75-1.61	
	No. hair relaxer burns					
	Nonuse*	0	1-2	3-4	5-9	≥10
	Cases	41	73	107	73	42
Person-years	11,134	22,258	29,289	20,663	11,108	15,473
IRR	Reference	0.91	1.11	1.12	1.25	1.21
95% CI	—	0.62-1.33	0.77-1.60	0.76-1.65	0.81-1.93	0.80-1.83
	Type of hair relaxer used					
	Nonuse*	Lye	No-lye	Unknown		
	Cases	41	50	237	55	
Person-years	11,134	13,187	67,708	15,301		
IRR	Reference	1.23	1.10	1.01		
95% CI	—	0.82-1.87	0.79-1.52	0.68-1.51		

\*Never used or &lt;1 y of use.

**Table 3. Risk of breast cancer in relation to duration of hair relaxer use among users with frequency ≥7 times per year according to age (<45, ≥45 y) in the Black Women's Health Study**

	Duration of hair relaxer use (y)					
	Nonuse*	1-4	5-9	10-14	15-19	≥20
Age <45 y						
Cases	12	1	2	10	18	22
Person-years	8,875	960	4,141	13,883	17,657	15,776
IRR	Reference	0.85	0.58	0.91	1.07	0.84
95% CI	—	0.11-6.52	0.13-2.62	0.38-2.16	0.51-2.25	0.42-1.71
Age ≥45 y						
Cases	41	4	4	9	12	57
Person-years	11,134	982	1418	2374	3378	16,694
IRR	Reference	1.16	0.82	1.15	1.13	1.03
95% CI	—	0.41-3.26	0.29-2.31	0.56-2.39	0.58-2.17	0.68-1.56

\*Never used or &lt;1 y of use.

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